Enablers of Success of AI-based Start-ups in India

Synopsis
Submitted in the partial fulfilment for the requirement of
Doctor of Philosophy
in
MANAGEMENT

Submitted by
POOJA KEWALRAMANI

Under the Supervision of
DR. JASPREET KAUR
Assistant Professor

PROF. SUMITA SRIVASTAVA
Co-Supervisor

PROF. FRANCISCO LINAN ALCALDE
Co-Supervisor
Department of Applied Business Economics
University of Sevilla, Spain

Department of Management, Faculty of Social Sciences
Dayalbagh Educational Institute (Deemed to be University)
Dayalbagh, Agra -282005
2024

1. Introduction

In today's world, Artificial Intelligence (AI) is evolving at a very high pace. Countries worldwide are becoming highly aware of the potential economic and social benefits of inventing and implementing AI. For instance, China and the U.K. project that 26% and 10% of their GDPs in 2030 will be generated from AI-related activities and organizations (Kumar et al., 2018).

India is also witnessing a drastic change in the IT world by digging deeper into machine learning, programming languages, and particularly AI. According to Accenture's latest AI report, AI will increase India's yearly growth rate by 1.3 per cent by 2035 where its GDP is projected to grow by USD 450–500 billion by 2025, or 10% of the country's USD 5 trillion GDP target (Swami et al., 2023).

The literature covers a wide range of technology types, from simple tools like cloud computing and customer relationship management (CRM) systems to more sophisticated ones like blockchain, AI, and the Internet of Things (IoT) (Gupta & Gupta, 2024; Zheng et al., 2017). Furthermore, AI technologies have attracted a lot of interest because of their capacity to transform business processes through automation, data analytics, and predictive insights. According to several academics, AI has the potential to increase economic growth and human productivity (Athey, 2018; E. Brynjolfsson et al., 2021; Furman and Seamans, 2019) and AI technologies help businesses become more profitable by creating a new virtual workforce through intelligent automation, increasing physical capital and enhancing the skills of the current workforce, assigning employees to more creative tasks, cutting costs, and earning high incomes (Svetlana et al., 2022). But for this macroeconomic growth to materialize, businesses must create and deploy AI-enabled goods and services for their own or their clients' usage.

The significance of AI-based SMEs and start-ups has been instrumental in democratizing access to AI technology and bringing it into homes and smaller enterprises. The number of registered AI firms in India is 2036 which is increasing as per the data on the Start-up India website (GOI, D. 2024). AI Index 2018 Annual Report indicates the growing significance of these businesses in the nation's entrepreneurial landscape (Shoham et al, 2018). This upsurge underscores the critical role that AI companies play in fostering creativity, economic growth, and technological advancement in addition to reflecting the growing interest in and investment in AI technologies (Thiebes, et al., 2021). AI has helped the business excel and meet significant space, marketing, customer relationship management, automation, and time

constraints challenges. India's education, healthcare systems, and so on are about to undergo a change driven by artificial intelligence (Soni et al., 2020).

Thus, it becomes imperative to help these organizations with solutions in the dynamic environment. Though many AI-based start-ups have been established recently, there have still been many failures of firms unable to sustain themselves in the competitive market (Weber et al., 2022). AI start-ups are optimistic about their work but still, they turn out to be failures after a few years of business. It is found in the literature and in preliminary survey that largely AI-based start-ups are operating at a very small scale catering the needs of a specific region (E. Brynjolfsson et al., 2021; Bulleri, 2023). However, their sustainability is a challenge which calls for urgent attention by the researchers (Chorev and Anderson, 2006; Mir et al., 2020). So, this proposal helps to identify those factors that enable AI-based start-ups' success and help them to sustain in the market.

It starts with the availability of resources, and technology to AI-based start-ups i.e., the use of social media platforms and search engines helps them to start their work on their idea (Bredt, 2019). Later, technological skilling helped them to provide digital solutions worldwide. Our agenda is to explore, analyse and understand the enablers of successful AI-based start-ups. Here, successful AI-based start-ups indicate they are able to sustain themselves in the market.

From gaining an understanding of the factors identified, policymakers can devise focused measures to promote activities which help start-ups sustain themselves and attain success, consequently promoting economic expansion and creating employment.

2. Literature Review

On reviewing the literature of more than 400 papers, it is found that AI is playing a significant role in changing the dynamics of the business (Martins, 2024; Olusegun Atiku and Anane-Simon, 2024). It has provided a competitive edge to the organizations and helped in operationalizing their firms effectively. There are studies which explain the determinants of digital technology/ICT/digital transformation/Industry 4.0. The role of digital technology/ICT/digital transformation is extensively covered in literature. Literature has largely talked about models like the TOE framework, TAM, and UTAUT model which have helped to adopt ICT in SMEs.

Table 1 Literature Review

Title, Year, author(s)	Region		Focus Area					Methodology		Study-based	
	Indian	International	Opportunities & challenges	Competitiveness	Ethical considerations	Critical success factors	Others	Qualitative	Quantitative	Tech-Based startups	AI-based start-ups
Enhancing the Competitiveness of AI Technology-Based Startups in the Digital Era (2023), by Lee et al.		√		√					√		√
A Comprehensive Investigation of AI-Based Start-Ups in India (2023), by Swami et al.	√						√		√		√
Entrepreneurial Strategies For AI Startups: Navigating Market and Investment Challenges (2023), by Kaggwa et al.		√	√					√			√
Critical Success factors for European AI startups (2022), by Filip Sorana-Oana		√				√			√		√
AI Startup Business Models (2022), by Weber et al.		√					√	√	√		√
The role of data for AI startup growth (2022), by Bessen et al.		√					√		√		√
Analysis of the Crucial Success Factors for Tech-Based Startups		√				√			√	√	

(2020), by S He, C Yu											
Critical success factors for integrating artificial intelligence and robotics (2020), by Mir et al.	√					√		√	√	√	√
Success in Israeli high-tech start-ups; Critical factors and process (2006), by Chorev		√				√		√	√	√	

Recently, there has been a lot of research on AI-Based start-ups comprehensively defining their business models (Bessen et al., 2023), including their way of increasing Financial performance (FP) (Singh & Hillemane, 2023), addressing their ethical issues (Kaggwa et al., 2023; Agbese et al., 2023; Bessen et al., 2022); providing data security to their users, using AI technologies in their product development (Bessen et al., 2023); investigating the business models of AI-Based firms with the common IT related businesses (Weber et al., 2022); and the Critical Success Factors (CSF) which are helping them to sustain in the dynamic world (Sorana-Oana, 2022). There are studies which are talking about the Critical Success Factors (CSF) for the sustainability of the AI-based start-ups like that of Filip Sorana-Oana (2022); He, Yu (2020); Mir et al. (2020); Chorev and Anderson (2006). These are based in Israel, Europe, Taiwan and India. The literature covers opportunities (Marler, 2024); challenges (Madanaguli et al., 2024); enhancement of competitiveness (Lee et al., 2023); as well as review-based perspective (Madanaguli et al., 2024) of AI-based start-ups. Furthermore, in the initial years of AI research, Chorev and Anderson (2006) explored CSF of high-tech ventures, presenting the external and internal environmental factors in the Israeli context. Filip Sorana-Oana (2022) have also identified the internal and external factors of European AI-based start-ups' success. Another study by Mir et al., (2020) identifies the CSFs for integrating intelligent autonomous systems (IAS) and Robotics. The literature has measured the CSFs which results in the success of AI-based firms. However, the understanding of success is limited and is not properly defined. The CSFs identified in the literature appear to be more

generic. Also, it is found the studies have limited sample size and limited scope. Table 1 contains the classification of the literature on certain criteria.

3. Theoretical Framework

Definition of Key terms-

1.1 AI-based start-up: The term Artificial Intelligence was first coined in 1956 by McCarthy along with other researchers. AI start-ups are innovative firms that use AI to offer cutting-edge solutions in various industries. These firms use AI technologies to advance industries like healthcare and finance and boost efficiency. The four main characteristics of artificial intelligence (AI) start-ups are that they are small businesses that use big data systems to boost their competitiveness, embrace AI technology, and go through a digital transformation (Lee et al., 2023). AI start-ups are distinguished by their innovative approach to solving challenging problems and fostering creativity through cutting-edge AI technologies like neural networks and machine learning algorithms. They frequently concentrate on topics like predictive analytics, autonomous vehicles, and customized healthcare (Ruchitha, 2024). AI start-ups are the solution providers for various sectors of businesses. They provide services in digital marketing, content creation, education, data management, advertising, and so on. AI start-ups typically emerge at the nexus of entrepreneurship, data, and technology to leverage AI's potential to address various industry concerns or generate new opportunities. They might design hardware that is suited for AI processing, develop AI software, construct AI-powered platforms, or create AI algorithms (techslang, 2023). AI is made up of a diverse range of devices, processes and algorithms. As shown in Fig. 1, there are various fields of AI including machine learning, experts systems, natural language processing, speech recognition, and so on (Kayid, 2020). It is kind of a digital computer system that mimics how the human brain interprets data. AI is referred to as neural network because it is structured similarly to how neurons in the brain are arranged, with their many neural nodes (Iftikhar et al., 2020). Artificial intelligence is related to computers or machines with computer assistance that can understand complex algorithms. These skills can help develop methods for applying more complex processes, like understanding human behavior, solving problems, deriving meaning from them, and learning from the past.

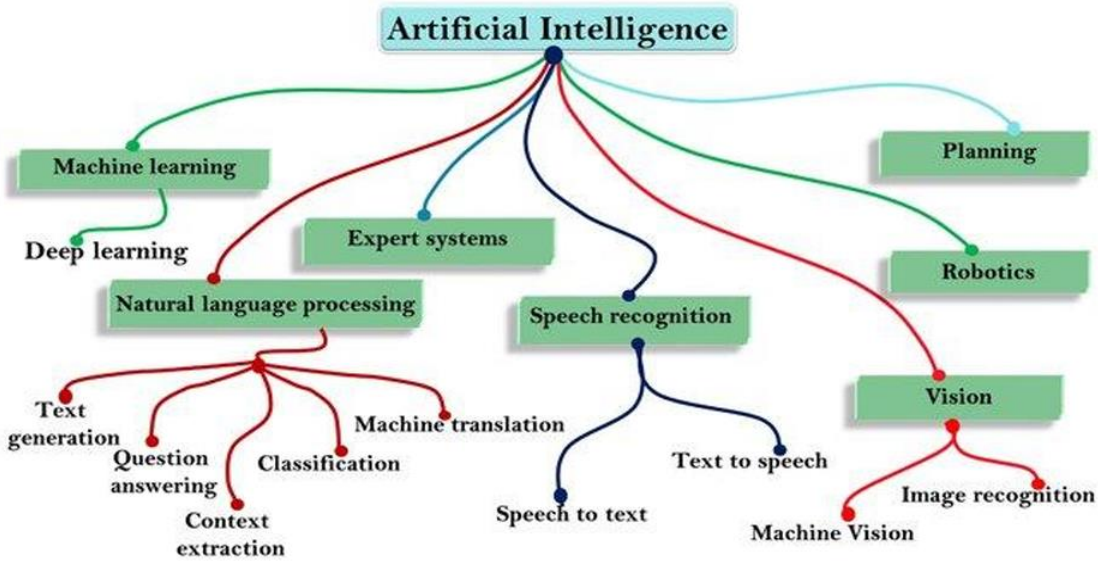

Fig. 1 Subfields of Artificial Intelligence
(Source: Kayid 2020**)**

3.2 Access to Funding: Access to funding moderately impacts AI startups (Filip, 2022). According to the rankings average it also has an impact on AI-based startups. The AI start-ups capacity to obtain funding is required for growth, processes, R&D, and operations. These include Venture capital, angel investment, Loans, revenue streams and so on.

3.3 Technology infrastructure: Technology infrastructure is characterized as a collection of interconnected Information Technology resources that serve as the basis for internal communication and the deployment of both current and future business applications. The two widely defined infrastructures that make up IT infrastructure are technical and human elements (Chanopas et al., 2006). Hardware resources, cloud computing services, software frameworks, development tools, security measures, and scalability architecture are the basic components of Technology infrastructure.

3.4 Availability of Data: The simplicity and scope with which an AI firm may obtain the data needed for training, validating, and testing AI models is referred to as data availability. According to (Agerfalk 2020; Berente et al. 2021; and Haenlein and Kaplan 2019), the advancements in machine learning, computational processing, and the general availability of big, high-quality datasets have given artificial intelligence (AI) an advantage in recent years.

3.5 Go-to-market (GTM) strategy: GTM strategy is a holistic approach that discusses the where; and

how of product launch, delivery and selling. It includes marketing, sales, distribution and so on (What Is a Go-To-Market Strategy? A Quick GTM Guide | Stripe, 2024). According to Gillis, 2024, a go-to-market strategy is a plan of action that outlines how a business will reach its target market and introduce a new product or service. A GTM strategy is considered a guide for delivering a good or service to the final consumer, accounting for distribution, cost-effectiveness, and promotion.

3.6 Product Development: In the study conducted by F Sorana-Oana, 2022, Product Development among the other key factors is the highly impactful factor in the success of AI startups. It is a process of forming, creating, and improving AI-based goods and services in response to consumer needs and technical developments.

3.7 Core Team Commitment: Team commitment is defined as members' psychological connection with their team (Singh & Gupta, 2015). Employees; dedication to their work team constitutes the core of team commitment (Bishop & Scott, 2000).

3.8 Core Team Expertise: A group of interdependent individuals with strong task-related expertise and team process ability are referred to as having core team expertise. These individuals are essential for making successful decisions and solving problems in challenging situations (Simona Tancig, 2009).

3.9 Market Need: The market need is an understanding of market demands, product development, and the marketing-entrepreneurship relationship which is important for the success of the business (Robert D. Hirisch, 2013).

3.10 Regulations: It is a subset of the broader algorithm's regulation. Companies using AI have a major role in developing and applying trustworthy AI, abiding by set standards, and accepting responsibility for risk mitigation.

3.11 Economic Situation: The economic situation refers to the condition of the economy, which includes factors like growth, inflation, and employment levels, that impact the performance of the enterprises.

3.12 Competition: Competitions play a crucial role in entrepreneurial ecosystems by acting as network hubs, connecting entrepreneurs, and relevant actors, and strengthening the overall quality of the ecosystem (Lennard Stolz, 2020).

3.13 Climate of Innovation: Santisteban et al. (2020) concluded that the climate of Innovation has a

direct impact on the success of technology-driven startups. Innovation gives a competitive advantage, helps in optimizing the use of resources and also generates financial conditions.

3.14 Innovation of Product/solutions: Product innovation refers to the creation and enhancement of new or improved products, services, or processes within a company or organization. This involves introducing novel ideas, technologies, features, or designs that add value for customers and distinguish the product from existing market offerings (Jain, 2023).

4. Research Gap

1. There are several studies identifying technology-based start-ups. However, there is a dearth of literature exploring AI-based start-ups.

2. Critical success factors of AI-based start-ups are yet to be explored extensively. Only marginal coverage in the literature is found.

3. AI-based start-ups are substantially rising in India @33.7% compound annual growth rate (IDC Report, 2024). However, only 1 study by Mir et al. (2020) has explored their enablers.

5. Research Questions

1. How is the success of AI-based start-ups defined?

2. What are the enablers of successful AI-based start-ups in India?

3. Are there any mediators and moderators between identified enablers and success of AI-based start-ups in India?

4. How it can be ensured that AI-based start-ups in India remain sustainable?

6. Theoretical Base

Van de Ven, 2007 proposed a model of engaged scholarship which involves both the researchers as well as the practitioners participating in the research to solve complex social issues which are not under the capability of the researcher alone. Researchers claim that the studies conducted in academics often lack relevance and the real-world problems faced in decision-making by management (Van de Van, 2018; Mohrman, Lawler III, and Associates, 2011, Bartunek & McKenzie, 2017). To increase the relevance of the research, the engagement of practitioners and other stakeholders is important as it increases the chances of gaining knowledge for science and practice (Van de Ven, 2018). He proposed a diamond model by which researchers can significantly increase the possibility of obtaining information that

advances both theory and practice.

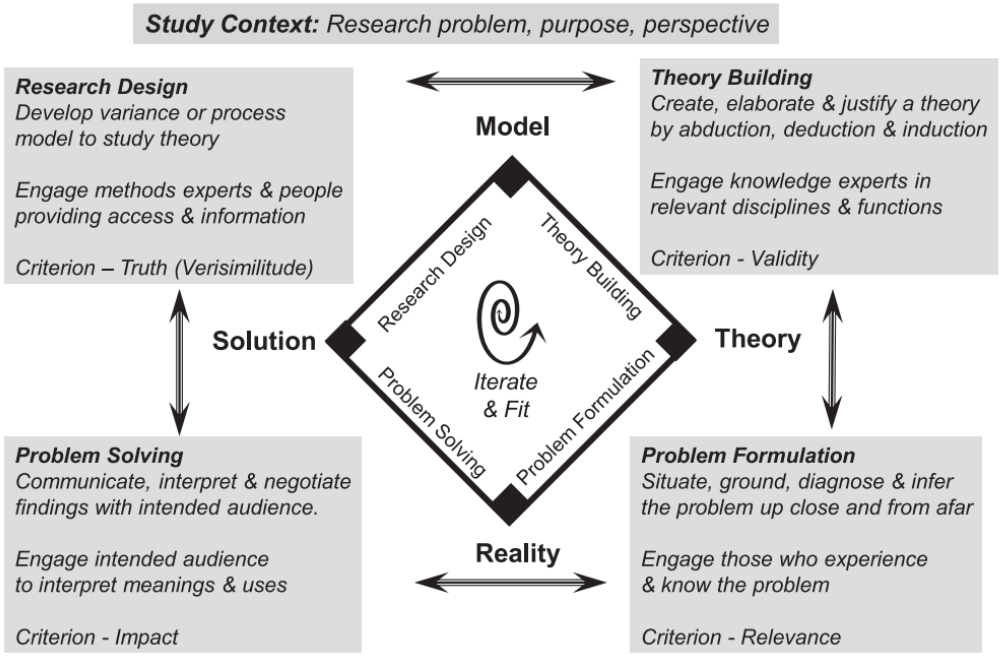
Study Context: Research problem, purpose, perspective
Research Design
Develop variance or process model to study theory
Engage methods experts & people providing access & information
Criterion – Truth (Verisimilitude)
Model
Theory Building
Create, elaborate & justify a theory by abduction, deduction & induction
Engage knowledge experts in relevant disciplines & functions
Criterion - Validity
Solution
Research Design
Theory Building
Iterate & Fit
Problem Solving
Problem Formulation
Theory
Problem Solving
Communicate, interpret & negotiate findings with intended audience.
Engage intended audience to interpret meanings & uses
Criterion - Impact
Reality
Problem Formulation
Situate, ground, diagnose & infer the problem up close and from afar
Engage those who experience & know the problem
Criterion - Relevance

Fig. 2 Engaged scholarship diamond model.

(Source: Van de Ven, 2007)

Fig. 2 shows the model developed by Van de Ven in 2007 which involves four study activities which can be enhanced if the stakeholders are engaged at the initial level of the research (Van de Ven, 2018). The current research uses this four-study diamond model developed by Van de Ven. This can be explained by the following:

1. **Problem Formulation:** Van de Ven explains that before situating and grounding your research problem and even diagnosing it, the researcher must identify the who, what, where, when, why, and how of the problem. In this study also, the area of research was identified through a thorough literature review and interviews with AI start-up owners. The researcher gathered first-hand insights into the challenges and reasons behind the high dropout rates in AI start-ups. This helped to diagnose the problem and understand its context.

2. **Theory Building:** Under this, provide possible alternatives (or theories) that tackle the issue as it exists in the given context. A review of relevant research and discussions with informed experts from the related functions and disciplines that have handled the problem are necessary for this (Van de Van, 2018). By reviewing relevant literature and interviewing experts, the researcher developed a theoretical

framework that identifies internal and external factors impacting the success of AI start-ups. The research problem was formulated to focus on understanding these factors and their relative importance.

3. **Research Design:** Collect empirical data in order to contrast the plausible substitute models that tackle the research issue. Usually, this calls for consulting with technical specialists in research methods, data access providers, and, of course, information informants or respondents **(**Van de Van, 2018). The researcher designed the research by preparing structured interview questions to gather empirical evidence from AI start-up owners. Then conducted these interviews, collected data, and ranked the factors impacting the success of AI start-ups. This evidence helped to compare and analyze different models of success.

4. **Problem Solving:** Discuss, evaluate, and apply the empirical results on which models provide a better answer to the problem's research issue. In order to resolve competing interests, this calls for written reports, presentations, and diplomatic and practical discussions (Van de Van, 2018). The findings were communicated by creating a conceptual framework and identifying the most impactful factors (both internal and external) using the weighted ranking method. This framework can be used to guide AI start-ups in addressing key issues and improving their chances of success. Further communication and collaboration with stakeholders can help interpret these findings and apply them effectively.

The practice of engaged scholarship can be done in different ways. It comprises Basic Informed Basic Research, collaborative, evaluation, and action research (Van de Ven, 2007). This research shows both the characteristics of research i.e., collaborative and evaluation research. As for the collaborative research, there was a direct and mutual engagement between AI start-up entrepreneurs and researchers in this study and also it involved theoretical sights from literature as well as practical insights from interviews, showing a collaborative research approach. The study involved assessing and ranking the factors that impact the success of AI start-ups, which aligns with evaluation research focusing on assessing effectiveness, efficiency, and impact. Also, direct feedback was taken from the stakeholders for the evaluation of various factors to identify the key factors.

Van de Ven's approach is applied in the proposed study. The researcher conducted the study by following a certain set of steps.

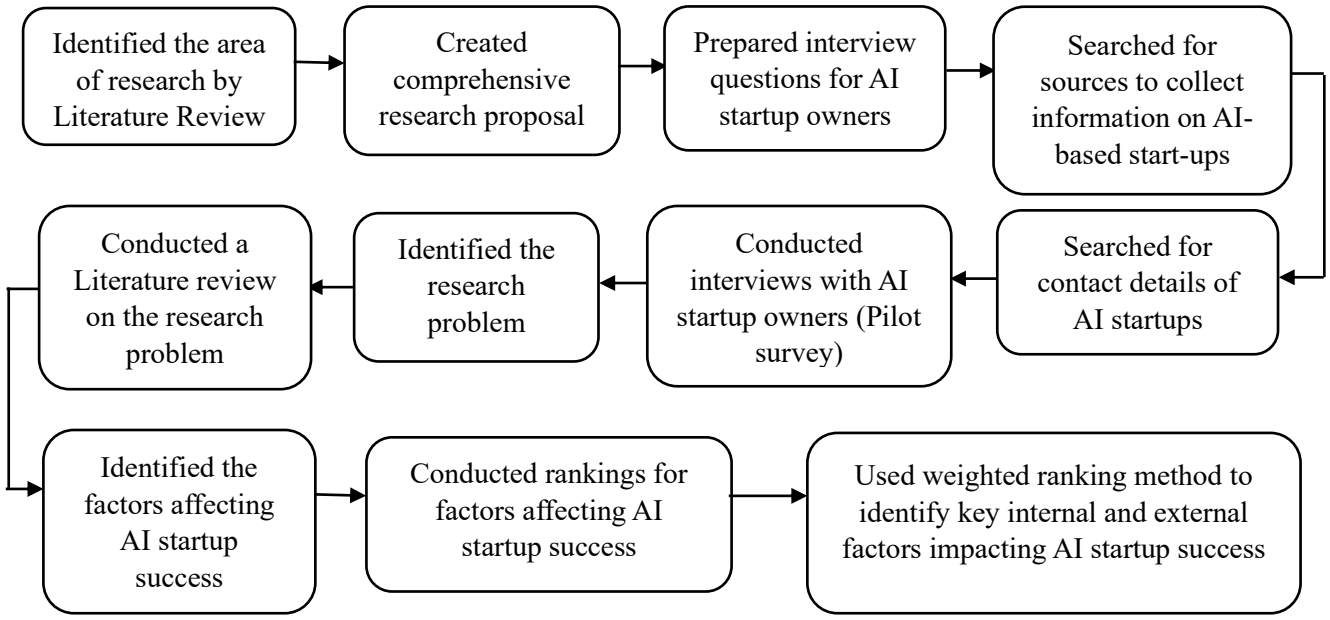
Identified the area of research by Literature Review
Created comprehensive research proposal
Prepared interview questions for AI startup owners
Searched for sources to collect information on AI-based start-ups
Searched for contact details of AI startups
Conducted interviews with AI startup owners (Pilot survey)
Identified the research problem
Conducted a Literature review on the research problem
Identified the factors affecting AI startup success
Conducted rankings for factors affecting AI startup success
Used weighted ranking method to identify key internal and external factors impacting AI startup success

Fig. 3 Process for identifying the factors affecting the success of AI start-ups
(Source: Author's self-construct)

Fig. 3 shows the process of identifying the factors affecting the success of AI-based start-ups conducted by the researcher. Initially, a thorough literature review was done on ICT and other advanced technologies to understand the latest themes and concepts surrounding SMEs and start-ups and impacting their businesses. By going deeper into the literature, AI caught researchers' attention as it is the most prevailing topic of the current time as well as it is the future of the world. Adoption of AI is increasing in every industry of India but focusing on the core firms which are actually based on AI is far more important in the current scenario. The comprehensive proposal was created to cover certain areas which help small businesses to grow and sustain in the competitive world. It was based on financial performance, marketing position, ethics, sustainability and more. In the same context, interview questions were made for the AI start-up owners which helped the researcher to better understand the current and real-life problems prevailing in the AI industry. A variety of sources were used to gather information on AI start-ups based in India, but only the Start-up India website was found to be the most pertinent and user-friendly. (List of Top Artificial Intelligence Companies (Top 10K) - Crunchbase Hub Profile, n.d.), and (Top 10 Artificial Intelligence (AI) Companies and Start-ups in Database Technology in Asia in Jul, 2024- Tracxn, 2024), among other start-up database sources, were seen as irrelevant and unrelated because one of the websites was for-profit, and the others had no accurate information on the AI sector. The contact information of AI start-up owners was taken from each company's website.

In order to understand the problems and current scenario of AI-based start-ups in India, a pilot study was conducted by the researcher. The objective of this pilot study was to explore the current status of AI-based start-ups in India. For this pilot project, a series of lists were created from the Start-up India website's database, which includes a comprehensive list of all the start-ups that are presently operating in India along with a range of details. With the use of certain DPIIT registered and AI sector filters, the start-ups from 133454 were reduced to 2036. From the 2036 start-ups, a list of 145 AI-based start-ups was prepared initially for the pilot survey. From this, only 57 AI start-ups' contact details were easily available. After contacting the 57 AI start-ups, only 21 responded and of these, only 10 agreed to an interview. These start-ups included all the stages of start-ups but at a later stage, the criteria are to select the sample from the population of scaling and early traction stage of AI start-ups only.

The interviews with AI start-up owners gave the idea of the real-life scenario running in the AI industry which caught the researcher's interest to know more about the factors affecting the success of AI-based start-ups as there are many businesses which tend to start their business with full passion and enthusiasm but end up closing it because of lack of skilled labour, heavy cost, unavailability of data and so on. After identifying the research problem, a literature review was done to learn more about the various past studies on the success factors of AI start-ups. Few studies were talking about the Critical success factors of AI-based start-ups in different regions like Israel, Europe, India and so on.

But there is still a need to explore more in the area of AI success factors in India. So, the thorough literature review helped the researcher to identify various factors affecting the success of AI start-ups. After framing all the factors on the basis of internal and external, again stakeholders were involved to know about the most impactful factors among the others which impact the success of AI start-ups. For this purpose, rankings were done by the start-up owners to pen out the most crucial factors affecting the success of the start-ups. The identified internal factors are- Access to Funding, Technology infrastructure, Availability of Data, Go to market strategy of the firm, Product Development, Core Team Commitment and Core Team Expertise. External factors are- Market needs, regulations, competition, and Economic situation. There is a moderating role of the climate of innovation in the success of AI start-ups. Analysis of the ranking of these factors was done by the Weighted Average Ranking method. According to the rankings, Availability of Data is the most impactful internal factor and market need is

the influential external factor in the success of AI start-ups.

7. Research Objectives

General Objective 1: To examine the relationship between Internal factors and the success of AI-based start-ups.

i. **Specific Objective 1**- To analyze the relationship between the Availability of Data and the success of AI-based start-ups.

ii. **Specific Objective 2-** To examine the relationship between Go-to-market strategy and the success of AI-based start-ups.

iii. **Specific Objective 3-** To investigate the relationship between Product development and the success of AI-based start-ups.

iv. **Specific Objective 4-** To study the relationship between Core Team commitment and the success of AI-based start-ups.

v. **Specific Objective 5-** To inspect the relationship between Core Team expertise and the success of AI-based start-ups.

vi. **Specific Objective 6-** To analyze the relationship between the Access to Funding and the success of AI-based start-ups.

vii. **Specific Objective 7-** To study the relationship between Technology infrastructure and the success of AI-based start-ups.

General Objective 2: To examine the relationship between External factors and the success of AI-based start-ups.

i. **Specific Objective 8-** To analyze the relationship between Market needs and the success of AI-based start-ups.

ii. **Specific Objective 9-** To examine the relationship between regulations and the success of AI-based start-ups.

iii. **Specific Objective 10-** To investigate the relationship between Economic situation and the success of AI-based start-ups.

iv. **Specific Objective 11-** To study the relationship between Competition and the success of AI-based start-ups.

General Objective 3: To analyze the moderating effect of the Climate of Innovation on the success of AI-based start-ups.

i. **Specific Objective 12-** To examine the moderating effect of the Climate of Innovation on the relationship between Internal factors and the success of AI-based start-ups.

ii. **Specific Objective 13-** To analyze the moderating effect of the Climate of Innovation on the relationship between External factors and the success of AI-based start-ups.

General Objective 4: To examine the moderating effect of Innovation of Products/solutions on the success of AI-based start-ups.

8. Conceptual Framework

The proposed model (Fig. 4) shows the pathway to success in AI start-ups. It is a framework developed by the authors and adapted from Chorev and Anderson 2006; Sorana-Oana, (2022). Initially, the factors were identified through a review of Literature in which the above two papers talk thoroughly about the Critical success factors of AI-based start-ups. The idea of finding the factors affecting the success of AI start-ups is based on a Pilot survey and a thorough literature review. For the pilot study, in-depth interviews were taken to identify the real cause or problem from the stakeholders itself. This was done to know the actual problem prevailing in the industry so that research can be carried out to help the stakeholders, users, policymakers and so on. After the analysis of the interviews, there was a common issue among all the start-ups which was related to the sustainability of the start-ups. The owners have the passion, knowledge, and skills to start the business but still, there are some things lacking which leads to the failure of their businesses. Thus, the primary concern is the driving forces that enable them to maintain their business before expanding it. The authors considered the necessity of determining those factors that contribute to the success of AI start-ups. Chorev and Anderson 2006; and Sorana-Oana, F. (2022) have talked about the internal and external factors affecting the success of AI-based start-ups. So, after reviewing both the papers the researcher found the need to conduct a study on the internal and external factors which affect the success of the AI start-ups in the Indian context.

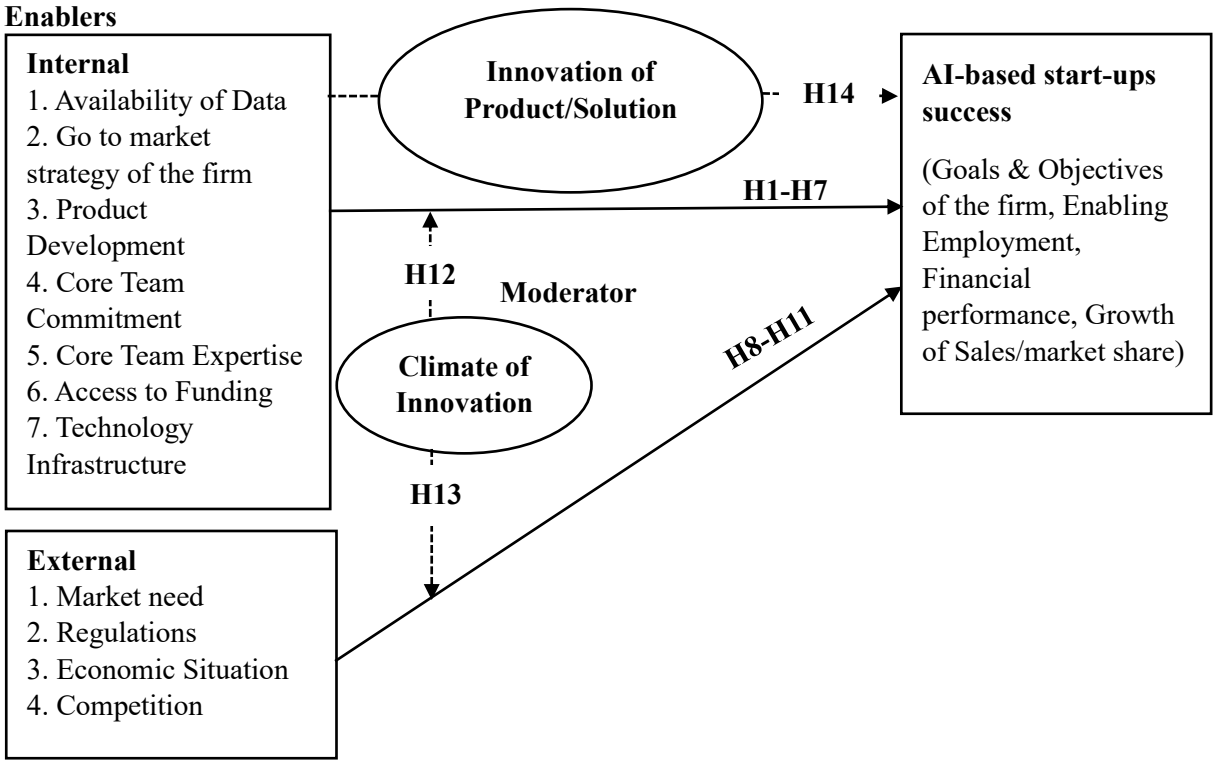

Fig. 4 Proposed Research Model
(Source: Adapted from Chorev and Anderson 2006; Sorana-Oana, F. 2022)

Both the previous studies have been done in the Israelian and European contexts. According to the findings of a recent study conducted in 2022 by Sorana-Oana, regulations and competition have the most external impact on the success of AI businesses, while core team skills and commitment have the greatest internal impact. By taking into consideration the interviews with the start-up owners, new factors were identified and then ranking was done by the start-up owners for the factors which have the most impact on the success of the business and then analysis was done by Weighted Ranking Method. Table 2 shows the results of the Weighted ranking method of internal and external factors.

Table 2 Rankings of Internal and External Factors for the success of AI-based start-ups

Internal Factors	Sum of Weights	Ranks	External Factors	Sum of Weights	Ranks
Availability of Data	57	1	Market Need	39	1
Go-to-market strategy	54	2	Regulations	31	2
Product Development	54	2	Economic Situation	28	3
Core Team Commitment	53	3	Competition	23	4
Core Team expertise	47	4			
Availability of Funds	47	4			
Technological Infrastructure	41	5			

9. Research Hypotheses

The proposed study will examine the relationship between internal factors (IF) and external factors (EF) and the success of AI-based start-ups. According to Sorana-Oana, F. (2022) and Santisteban et al. (2020), there is also a moderating role of the Climate of innovation between IF and EF with the AI start-up's success. Previous studies show the relationship between IF and AI success as well as EF with AI success (Chorev and Anderson 2006; Sorana-Oana, F. (2022)). Fig. 3 shows the relationship between independent variables, IF and EF with the dependent variable, AI success. Also, the moderating effect of the climate of innovation. This relationship is based on the literature (Chorev and Anderson 2006; Sorana-Oana, F. (2022)) and the interviews taken with the AI start-up owners, the analysis of which is shown in Table 2. There are 14 hypotheses framed as shown in Fig. 3.

9.1 Hypotheses on Internal factors

The internal factors are the integral part which determines the success of start-ups. The Chorev and Anderson (2006) and Sorana-Oana, F. (2022) research model show that internal factors are critical factors impacting start-ups' success. In Chorev and Anderson (2006) model, Strategy, Core Team Commitment, Core Team Expertise, Customer Relations, Management, Product Development and Marketing Strategy are the highest impacting factors in the success of AI-based start-ups whereas in our research model strategy, customer relations, and Management are not as impactful in the success of AI-based start-ups. The proposed research model shows Access to Funding, Technology Infrastructure, Availability of Data, Go-to-market strategy, Product Development, Core team expertise, Core team commitment as the most impactful factors in the success of the start-up. It is based on the Rankings of the AI start-up owners. Sorana-Oana, F. (2022) model also shows the internal factors impacting the success of AI businesses. According to their study, CTE and CTC were the highest impacting factors in the success of start-ups. The following are the hypotheses framed based on these studies as well as the rankings done by the researcher:

H_1: Access to Funding has an impact on the AI-based start-up success.

H_2: Technology Infrastructure has an impact on the AI-based start-up success.

H_3: Availability of Data has an impact on the AI-based start-up success.

H_4: Go-to-market strategy has an impact on the AI-based start-up success.

H_5: Product Development has an impact on the AI-based start-up success.

H_6: Core team expertise has an impact on the AI-based start-up success.

H_7: Core team commitment has an impact on the AI-based start-up success.

9.2 Hypotheses on External factors

The proposed research model shows the highest impacting external factors on the success of AIBSS. Initially, Chorev and Anderson (2006) in his paper identified the most impactful external factors (Economical Situation, Political Situation and General Environment) and Sorana-Oana, F. (2022) added new external factors (Competition and Regulations) which seem to have an impact in the European context. The current proposal considered all the external factors of both studies and after rankings with the AI start-up owners, following four factors i.e., Market Need (MN), Regulations (RE), Economic situation (ES), Competition (CO) were identified as most impactful in the success of AIBSS. MN was taken due to its relevance in the Indian context. The rankings shown in Table 2 indicate external factors' impact on AIBSS. The following are the hypotheses framed:

H_8: Market need has an impact on AI-based start-up success.

H_9: Regulations have an impact on AI-based start-up success.

H_{10}: Economic situation has an impact on AI-based start-up success.

H_{11}: Competition has an impact on AI-based start-up success.

9.3 Hypotheses on Climate of Innovation

Innovation impacts the business' performance and survival (Aminova and Marchi, 2021; Kim et al. 2018). Sorana-Oana, F. (2022) has shown that the climate of innovation has a moderating impact on ISF, ESF and AIBSS. In Indian aspect there is no study which proves the moderating role of climate of innovation between ISF, ESF and AIBSS. So, the present study proposes to analyse it and the following hypotheses are framed:

H_{12}: Climate of innovation moderates the relationship between ISF and AI-based start-up success.

H_{13}: Climate of innovation moderates the relationship between ESF and AI-based start-up success.

9.4 Hypotheses on Innovation of Product/Solution

Innovation in AI positively impacts the success of products and services (Jianjun et al., 2021). Product innovation is considered the most important aspect of the success of businesses (Henard and Szymanski,

2001). It becomes essential to know the impact of innovation of the Product/solutions on the relationship between Product development and the success of AI-based start-ups.

H_{14}: Innovation of Product/ Solution moderates the relationship between PD and AI-based start-up success.

10. Methodology

1. Research Design

This research is exploratory, empirical and descriptive. It was an exploratory sort of research in the beginning since factors were found through the literature and interviews with AI start-up owners in order to determine their primary concerns. The research takes on a descriptive role once the determinants have been identified, to describe the relationships between these factors and the success of AI start-ups. The data will be analyzed and interpreted by the researcher to produce a comprehensive description of these relationships. Empirical research will be applied to the data collection and analysis phase, where the researcher will empirically test the relationships between identified factors using data from interviews and questionnaires.

Table 3 Stages of start-ups (as per the Start-up India website)

Stages	Definition (as per Start-up India website)	Number of start-ups registered
Ideation	where the business owner is attempting to realize an intriguing idea and working on bringing it to life	508
Validation	When the firm has been established, it's time to launch and attract its first round of customers.	773
Early traction	When a start-up has made a name for itself with its initial customers, KPIs play a crucial role in the growth model.	639
Scaling	When a start-up crosses the valley of death and successfully achieves product-market fit, it can grow or raise money.	116

2. Sampling method

The proposed study will use a mixture of non-probability sampling methods and has used purposive sampling as the contacts for interviews were made to those owners whose information was available. Also, using the LinkedIn site to engage with start-up owners and others, the research will employ the snowball sampling method as well.

3. Target population

The population of the study is the owners of AI-based start-up businesses in India, which are registered

in DPIIT-recognized start-ups on the Start-up India website. A total of 2036 AI-based start-ups are registered from which only the scaling and earlytraction stage of start-up has been considered i.e., 755 as shown in Table 3.

4. Sample size

After analyzing various formulas and methods to calculate sample size under the non-probability sampling technique, Sample to variable(s) ratio method by Hair et al., 2018 is selected to calculate the sample size of the study. There are three ratios 5:1, 15:1 and 20:1. Due to the complexity and potential variability in the data, a higher sample-to-variable ratio is taken i.e., 20:1. Sample Size Calculation: As we have 11 variables in total including Internal and External, so the sample size will be 20:1 Ratio: 11×20 = 220.

Additionally, our sample size satisfies the minimal requirements as well, with 10%–15% of the target population i.e., 755*15% = 113, as a general rule of thumb.

REFERENCES

Agbese, M., Mohanani, R., Khan, A., & Abrahamsson, P. (2023, June). Implementing ai ethics: Making sense of the ethical requirements. In Proceedings of the 27th International Conference on Evaluation and Assessment in Software Engineering (pp. 62-71).

Ågerfalk, P. J. (2020). Artificial intelligence as digital agency. *European Journal of Information Systems*, *29*(1), 1-8.

Almansour, M. (2023). Artificial intelligence and resource optimization: A study of Fintech start-ups. *Resources Policy*, *80*, 103250.

Aminova, M., & Marchi, E. (2021). The role of innovation on start-up failure vs. its success. *International Journal of Business Ethics and Governance*, 41-72.

Anane-Simon, R., & Atiku, S. O. (2024). Artificial Intelligence and Automation for the Future of Start-ups. In *Ecosystem Dynamics and Strategies for Start-ups Scalability* (pp. 133-153). IGI Global.

Athey, S. (2018). The impact of machine learning on economics. *The economics of artificial intelligence: An agenda*, 507-547.

Bartunek, J. M., & McKenzie, J. (2017). Reviewing the state of academic practitioner relationships. In *Academic-Practitioner Relationships* (pp. 1-10). Routledge.

Berente, N., Gu, B., Recker, J., & Santhanam, R. (2021). Managing artificial intelligence. *MIS quarterly*, *45*(3).

Bessen, J. E., Impink, S. M., Reichensperger, L., & Seamans, R. (2023). The business of AI start-ups. Boston Univ. School of Law, Law and Economics Research Paper, (18-28).

Bessen, J., Impink, S. M., & Seamans, R. (2022, July). The cost of ethical AI development for AI start-ups. In Proceedings of the 2022 AAAI/ACM Conference on AI, Ethics, and Society (pp. 92-106).

Bishop, J. W., & Scott, K. D. (2000). An examination of organizational and team commitment in a self-directed team environment. *Journal of applied psychology*, *85*(3), 439.

Bredt, S. (2019). Artificial Intelligence (AI) in the financial sector—Potential and public strategies. Frontiers in Artificial Intelligence, 2, 16.

Brynjolfsson, E., Jin, W., & McElheran, K. (2021). The power of prediction: predictive analytics, workplace complements, and business performance. Business Economics, 56, 217-239.

Bulleri, M. (2023). How early-stage, deep-tech start-ups shape markets: Abzu and the new market category of" Scientific AI".

Chanopas, A., Krairit, D., & Ba Khang, D. (2006). Managing information technology infrastructure: a new flexibility framework. *Management Research News*, *29*(10), 632-651.

Chorev, S., & Anderson, A. R. (2006). Success in Israeli high-tech start-ups; Critical factors and process. Technovation, 26(2), 162–174. https://doi.org/10.1016/j.technovation.2005.06.014

Furman, J., & Seamans, R. (2019). AI and the Economy. *Innovation policy and the economy*, *19*(1), 161-191.

Gillis, A. S. (2024, June). What is a Go-To-Market Strategy (GTM strategy) and How Do You Build One? SearchITChannel. https://www.techtarget.com/searchitchannel/definition/go-to-market-strategy-GTM-strategy

GOI, D. (2024). Search. Www.start-upindia.gov.in. https://www.start-upindia.gov.in/content/sih/en/search.html?industries=5f48ce5f2a9bb065cdfa1733&roles=Start-up&page=0

Gupta, M., Gupta, D., & Rai, P. (2024). Exploring the Impact of Software as a Service (SaaS) on Human Life. *EAI Endorsed Transactions on Internet of Things*, *10*.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2018). Multivariate Data Analysis (8th ed.). United Kingdom: Cengage Learning.

He, S., & Yu, C. (2020). Analysis of the crucial success factors for tech-based start-ups. *International Journal of*.

Henard, D. H., & Szymanski, D. M. (2001). Why some new products are more successful than others. *Journal of marketing Research*, *38*(3), 362-375.

Hisrich, R. D., & Kearney, C. (2013). *Managing innovation and entrepreneurship*. Sage Publications.

Iftikhar, S., Shahid, S., Hassan, M. U., & Ghias, M. (2020). Assessment and prediction of restless leg syndrome (RLS) in patients with diabetes mellitus type II through artificial intelligence (AI). *Pakistan Journal of Pharmaceutical Sciences*, *33*.

Jain, N. (2023, June 27). What is Product Innovation? Definition, Types, Examples and Strategy Best Practices. IdeaScale. https://ideascale.com/blog/product-innovation/

Jianjun, H., Yao, Y., Hameed, J., Kamran, H. W., Nawaz, M. A., Aqdas, R., & Patwary, A. K. (2021). The role of artificial and nonartificial intelligence in the new product success with moderating role of new product innovation: a case of manufacturing companies in China. *Complexity*, *2021*(1), 8891298.

Kaggwa, S., Akinoso, A., Dawodu, S. O., Uwaoma, P. U., Akindote, O. J., & Osawaru, S. E. (2023). Entrepreneurial strategies for AI start-ups: navigating market and investment challenges. International Journal of Management & Entrepreneurship Research, 5(12), 1085-1108.

Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business horizons*, *62*(1), 15-25.

Kayid, A. (2020). The role of Artificial Intelligence in future technology. *Department of Computer Science, The German University in Cairo*.

Kim, M. K., Park, J. H., & Paik, J. H. (2018). Factors influencing innovation capability of small and medium-sized enterprises in Korean manufacturing sector: Facilitators, barriers and moderators. *International Journal of Technology Management*, *76*(3-4), 214-235.

Kumar, A., Shukla, P., Sharan, A., & Mahindra, T. (2018). National Strategy for Artificial Intelligence.

In *NITI Aayog* (pp. 1–114). NITI Aayog. https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

Lee, B., Kim, B., & Ivan, U. V. (2023). Enhancing the Competitiveness of AI Technology-Based Start-ups in the Digital Era. Administrative Sciences, 14(1), 6.

List of top Artificial Intelligence Companies (Top 10K) - Crunchbase Hub Profile. (n.d.). Crunchbase. https://www.crunchbase.com/hub/artificial-intelligence-companies

Madanaguli, A., Sjödin, D., Parida, V., & Mikalef, P. (2024). Artificial intelligence capabilities for circular business models: Research synthesis and future agenda. *Technological Forecasting and Social Change*, *200*, 123189.

Marler, J. H. (2024). Artificial intelligence, algorithms, and compensation strategy: Challenges and opportunities. *Organizational Dynamics*, 101039.

Martins, M. M. R. (2024). Start-up Guide to AI: Integrating Technology for Business Success. *Valley International Journal Digital Library*, 1264-1274.

Mir, U. B., Sharma, S., Kar, A. K., & Gupta, M. P. (2020). Critical success factors for integrating artificial intelligence and robotics. Digital Policy, Regulation and Governance, 22(4), 307-331.

Mohrman, S. A., & Lawler, E. E. (2011). Research for theory and practice. *Useful research: Advancing theory and practice*, 9-33.

Rajaraman, V. (2014). JohnMcCarthy—Father of artificial intelligence. *Resonance*, *19*, 198-207.

Ruchitha. (2024, April 12). Everything you need to know about the artificial intelligence start-ups - MySBA. Swavalambi Bharat Abhiyan. https://mysba.co.in/everything-you-need-to-know-about-the-artificial-intelligence-start-ups/

Santisteban, J., Mauricio, D., & Cachay, O. (2021). Critical success factors for technology-based start-ups. *International Journal of Entrepreneurship and Small Business*, *42*(4), 397-421.

Shivalik Singh GOI, D. (2024). Search. Www.start-upindia.gov.in. https://www.start-upindia.gov.in/content/sih/en/search.html?industries=5f48ce5f2a9bb065cdfa1733&roles=Start-up&page=0

Singh, A., & Gupta, B. (2015). Job involvement, organizational commitment, professional commitment, and team commitment: A study of generational diversity. *Benchmarking: An International*

Journal, *22*(6), 1192-1211.

Soni, N., Sharma, E. K., Singh, N., & Kapoor, A. (2020). Artificial intelligence in business: from research and innovation to market deployment. *Procedia Computer Science*, *167*, 2200-2210.

Sorana-Oana, F. (2022). Critical success factors for European AI start-ups.

Stolz, L. (2020). Start-up competitions and their role in entrepreneurial ecosystems: A conceptual attempt. *Zeitschrift für Wirtschaftsgeographie*, *64*(4), 233-246.

Svetlana, N., Anna, N., Svetlana, M., Tatiana, G., & Olga, M. (2022). Artificial intelligence as a driver of business process transformation. Procedia Computer Science, 213, 276-284.

Swami, A. R., Kumbhar, V. S., & Kharade, K. G. (2023). A Comprehensive Investigation of AI-Based Start-Ups in India. International Research Journal of Humanities and Interdisciplinary Studies, 1–8.

Tancig, S. (2009). Expert team decision-making and problem solving: Development and learning. *Interdisciplinary Description of Complex Systems: INDECS*, *7*(2), 106-116.

techslang. (2023, October 5). What Is an AI Start-up? — Techslang. Techslang — Tech Explained in Simple Terms. https://www.techslang.com/definition/what-is-an-ai-start-up/

Thiebes, S., Lins, S., & Sunyaev, A. (2021). Trustworthy artificial intelligence. Electronic Markets, 31, 447-464.

Top 10 Artificial Intelligence (AI) companies and start-ups in Database Technology in Asia in Jul, 2024- Tracxn. (2024, July 12). Tracxn.com. https://tracxn.com/d/artificial-intelligence/ai-start-ups-in-database-technology-in-asia/__FNLzzBiMDew60S9xiglNklUxUGXTnYkyfY3jET5HbRc/companies

Van de Ven, A. H. (2007). *Engaged scholarship: A guide for organizational and social research*. Oxford University Press, USA.

Van de Ven, A. H. (2018). Academic-practitioner engaged scholarship. *Information and Organization*, *28*(1), 37-43.

Weber, M., Beutter, M., Weking, J., Böhm, M., & Krcmar, H. (2022). AI Start-up Business Models: Key Characteristics and Directions for Entrepreneurship Research. Business & Information Systems Engineering, 64(1), 91-109.

What is a go-to-market strategy? A quick GTM guide | Stripe. (2024, June 6). Stripe.com. https://stripe.com/in/resources/more/what-is-a-go-to-market-strategy-a-quick-gtm-guide-for-start-ups#differences

Zhang, D., Mishra, S., Brynjolfsson, E., Etchemendy, J., Ganguli, D., Grosz, B., ... & Perrault, R. (2021). The AI index 2021 annual report. *arXiv preprint arXiv:2103.06312*.

Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017, June). An overview of blockchain technology: Architecture, consensus, and future trends. In 2017 IEEE international congress on big data (BigData congress) (pp. 557-564).